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Rev. 0

Sampling and Analysis Plan for the 276-S-141/142 Hexone Tank Stabilization/ Characterization Project

United States
Department of Energy

CONCURRENCE:

12/21/00

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December 2000

United States Department of Energy

P.O. Box 550, Richland, Washington 99352

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ACRONYMS

BHI	Bechtel Hanford, Inc.
COC	contaminant of concern
DOE	U.S. Department of Energy
DQO	data quality objective
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
ERC	Environmental Restoration Contractor
FSP	field sampling plan
FY	fiscal year
HASQARD	*Hanford Analytical Services Quality Assurance Requirements Document*
HEIS	Hanford Environmental Information System
HSRCM	*Hanford Site Radiological Control Manual*
NOC	Notice of Correction
QA	quality assurance
QAPjP	quality assurance project plan
QC	quality control
RCRA	*Resource Conservation and Recovery Act of 1976*
REDOX	Reduction-Oxidation (Facility)
RL	U.S. Department of Energy, Richland Operations Office
RWP	radiological work permit
SAF	sample authorization form
SAP	sampling and analysis plan
S/M&T	Surveillance/Maintenance and Transition
SOP	standard operating procedure
Tri-Party Agreement	*Hanford Federal Facility Agreement and Consent Order*
TRU	transuranic
TSD	treatment, storage, and disposal
UCL	upper confidence level
WAC	*Washington Administrative Code*

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METRIC CONVERSION CHART

Into Metric Units			Out of Metric Units		
If You Know	*Multiply By*	*To Get*	*If You Know*	*Multiply By*	*To Get*
Length			**Length**		
inches	25.4	millimeters	millimeters	0.039	inches
inches	2.54	centimeters	centimeters	0.394	inches
feet	0.305	meters	meters	3.281	feet
yards	0.914	meters	meters	1.094	yards
miles	1.609	kilometers	kilometers	0.621	miles
Area			**Area**		
sq. inches	6.452	sq. centimeters	sq. centimeters	0.155	sq. inches
sq. feet	0.093	sq. meters	sq. meters	10.76	sq. feet
sq. yards	0.0836	sq. meters	sq. meters	1.196	sq. yards
sq. miles	2.6	sq. kilometers	sq. kilometers	0.4	sq. miles
acres	0.405	hectares	hectares	2.47	acres
Mass (weight)			**Mass (weight)**		
ounces	28.35	grams	grams	0.035	ounces
pounds	0.454	kilograms	kilograms	2.205	pounds
ton	0.907	metric ton	metric ton	1.102	ton
Volume			**Volume**		
teaspoons	5	milliliters	milliliters	0.033	fluid ounces
tablespoons	15	milliliters	liters	2.1	pints
fluid ounces	30	milliliters	liters	1.057	quarts
cups	0.24	liters	liters	0.264	gallons
pints	0.47	liters	cubic meters	35.315	cubic feet
quarts	0.95	liters	cubic meters	1.308	cubic yards
gallons	3.8	liters			
cubic feet	0.028	cubic meters			
cubic yards	0.765	cubic meters			
Temperature			**Temperature**		
Fahrenheit	subtract 32, then multiply by 5/9	Celsius	Celsius	multiply by 9/5, then add 32	Fahrenheit
Radioactivity			**Radioactivity**		
picocuries	37	millibecquerel	millibecquerel	0.027	picocuries

1.0 INTRODUCTION

This sampling and analysis plan (SAP) presents the planning strategy, procedures, and implementation for the sampling and analysis activities proposed in support of the 276-S-141/142 Hexone Tank Characterization/Stabilization Project. Section 1.0 presents project background information and rationale for sampling and analytical strategies to ensure that cost-effective and timely data are available to support tank characterization/stabilization activities. Section 2.0 presents the quality assurance project plan (QAPjP) and the activities and guidelines to provide data of known and appropriate quality. Section 3.0 presents the field sampling plan (FSP) and identifies the field procedures to ensure the collection of representative data of known quality. Section 4.0 discusses heath and safety requirements and work control processes.

The sampling and analysis strategy developed in this SAP will be used to provide data to support an engineering study to evaluate potential interim actions concerning the tank facility. The following items will be implemented under this task:

- Collect and analyze tank waste residues in order to designate the materials in accordance with the requirements of *Washington Administrative Code* (WAC) 173-303.

- Collect and characterize tank waste residues to provide data to support an engineering evaluation of the hexone tanks during fiscal year (FY) 2001.

- Collect and characterize tank waste residues to provide sufficient data to support potential interim tank actions (as determined by the engineering study).

1.1 BACKGROUND

The 276-S-141/142 hexone storage tanks are two 89,000-L (23,575-gal), carbon-steel, underground storage tanks located near the Reduction-Oxidation (REDOX) Facility on the Hanford Site. Each tank contains up to 950 L (250 gal) of residual process materials. The 276-S-141/142 hexone storage tanks are managed as a treatment, storage, and disposal (TSD) facility (Permit #WA7890008967, for waste codes D001, F003, and WT02) and are regulated by the Washington State Department of Ecology (Ecology). In May 2000, Ecology issued *Notice of Correction for Stabilization of the Hexone Storage and Treatment Facility, BHI Docket Number 00NWPKM006* (Ecology 2000), citing several findings concerning operation of the tank system.

The tanks were constructed in 1951 and were used until 1967 to store industrial-grade hexone for use in the plutonium and uranium extraction process in the REDOX Facility. The tanks were subsequently used until 1990 to store radioactively contaminated organic liquids from the REDOX Plant. Tank 276-S-141 held 75,700 L (20,000 gal) of essentially pure liquid hexone, contaminated with small amounts of fission products (0.0004 Ci). Tank 276-S-142 contained substantially more fission products (0.12 Ci). The two tanks also held a combined total of 0.7 Ci of tritium.

Pumpable liquids were reportedly removed from the tanks, distilled, and disposed in 1991. After removal and distillation of the tanks' liquid contents, the tanks each contained approximately 950 L (250 gal) of residual organic radioactive materials. The tanks were permitted by Ecology as a TSD facility in 1992. A closure plan was submitted to Ecology as a part of the permitting process.

1.1.1 Site Conceptual Model

Photographs of the tank residual contents were obtained through the 4-in. risers in December 1990 after the tanks were emptied. The photographs indicate a layer of solid and liquid residue in each tank estimated at up to 950 L (250 gal). This estimate is based on the portion of the tank contents found at the bottom of each tank that could not be evacuated through the tank risers. The solid portion of the residue, approximately 870 L (230 gal), in each tank is expected to be composed of a homogenous mixture, composed primarily of corrosion materials from the tank combined with lesser amounts tributyl phosphate, normal paraffin hydrocarbons, hexone, radionuclides from the REDOX process, and possibly water. A small volume of liquid residue, approximately 75 L (20 gal), was also observed in each tank. The liquid residue is expected to be composed of a homogenous mixture of normal paraffin hydrocarbons, hexone, radionuclides from the REDOX process, and possibly water (BHI 2000a).

The Part A permit states that each tank may also contain a tar-like material that was inadvertently added to the tank during the distillation process. This tar-like material is likely to be found in accumulations at the ends of each tank immediately beneath the 24-in.-diameter manhole. The tar-like material is expected to be a concentrated form of the tank constituents listed above (e.g., corrosion products, organic materials, and radionuclides from the REDOX process). The presence of this tar-like material cannot be confirmed in the 1990 photographs.

1.1.2 Current Configuration

A nitrogen blanket is maintained in the tanks to control the potentially flammable atmospheres. A nitrogen dewar is used to supply nitrogen gas to each tank through a piping system that connects the two tanks and is routed to a high-efficiency particulate air filter and bank of activated charcoal filters before being evacuated to the atmosphere. Recent sampling and evaluation of the tank vapors indicate that the nitrogen blanket is effective in mitigating the potentially flammable atmospheres in the tanks. The nitrogen blanket will be maintained in each tank during sampling operations. In addition, use of potential ignition sources at the facility is controlled.

1.2 CONTAMINANTS OF CONCERN

Table 1-1 presents the final list of contaminants of concern (COCs) for the tanks' contents based on the *Data Quality Objectives Summary Report for 276-S-141/142 Hexone Tank Characterization/Stabilization Project* (BHI 2000a).

Table 1-1. Final List of COCs.

Radionuclides		
Americium-241 Curium-244 Carbon-14 Cesium-137 Cobalt-60 Europium-152	Europium-154 Europium-155 Hydrogen-3 Plutonium-238 Plutonium-239/240	Total radioactive strontium Technetium-99 Uranium-234 Uranium-235 Uranium-238
Chemicals		
Organics		
n-Butyl alcohol Kerosene (paraffin hydrocarbons) 2-propanone (acetone)	2-butanone 4-methyl-2-pentanone (hexone) 2-hexanone	Tributyl phosphate Polychlorinated biphenyls
Inorganics		
Cyanide Phosphate Sulfate	Nitrate Nitrite	Chloride Sulfides
Metals		
Mercury (total and TCLP) Lead (total and TCLP) Nickel Silver (total and TCLP) Antimony	Arsenic (total and TCLP) Barium (total and TCLP) Beryllium Cadmium (total and TCLP) Chromium (total and TCLP)	Copper Selenium (total and TCLP) Uranium (total)

TCLP = toxicity characteristic leachate procedure

1.3 DATA QUALITY OBJECTIVES

The U.S. Environmental Protection Agency's (EPA's) data quality objective (DQO) guidance (EPA 1994) was used to support the development of this SAP. The DQO guidance provides a strategic planning approach using a systematic procedure for defining the criteria that a data collection design should satisfy. Using the DQO process ensures that the type, quantity, and quality of environmental data used in decision making will be appropriate for the intended application.

This section presents only a summary of the key outputs resulting from the implementation of the seven-step DQO process. For additional details, refer to the DQO summary report (BHI 2000a).

1.3.1 Statement of the Problem and Decision Rules

This subsection identifies the problem statements for the hexone tank characterization/ stabilization and the associated sampling and analysis. The decision statements associated with these problems are identified in Table 1-2.

In May 2000, a Notice of Construction NOC was issued by Ecology regarding current operation of the 276-S-141/142 hexone tanks. In partial response to the NOC, the process was initiated to develop a sampling and analysis strategy to provide waste characterization and designation data. The data collected by this effort will be used to designate the residual materials in accordance with the requirements of WAC 173-303. The data will also be used to support an engineering study during FY 2001 that will identify interim actions to stabilize the tank system and to support closure of the facility.

These problem statements are translated into decision statements in the DQO summary report (BHI 2000a and are identified in Table 1-2.

Table 1-2. Decision Statements. (2 Pages)

DS #	Decision Statement
1	Do the contaminant concentrations within the hexone tank contents exceed the TRU[a] definition?
2	Do the radionuclide concentrations within the hexone tank contents exceed the annual radiological exposure limits for human health protection under an industrial exposure scenario?
3	Do the constituents within the hexone tanks exceed the nonradiological cleanup levels under MTCA Method B?
4	Does the hexone tank conceptual model properly reflect the chemical/physical characteristics and distribution of contaminants within the tanks?
5	Does the waste material radiological activity or chemical and/or physical properties exceed the disposal facility waste acceptance criteria limits?
5a	Does the waste material radiological activity exceed the disposal facility waste acceptance criteria limits?
5b	Do the waste material chemical and/or physical properties exceed the disposal facility waste acceptance criteria limits?
6	Determine if the hexone tank contents designate as dangerous[b], polychlorinated biphenyl, or asbestos waste.
6a	Determine if the hexone tank contents are regulated as listed dangerous waste.
6b	Determine if the characteristic waste codes (e.g., corrosivity, ignitability, reactivity, and toxicity) apply to the hexone tank contents.
6c	Determine if the hexone tank contents meet the definition of a toxic dangerous waste per Washington State criteria.

Table 1-2. Decision Statements. (2 Pages)

DS #	Decision Statement
6d	Determine if the hexone tank contents meet the definition of a persistent waste per Washington State criteria.
6e	Determine if the hexone tank contents are regulated due to polychlorinated biphenyl concentrations.
6f	Determine if the hexone tank contents are regulated due to asbestos content.
7	Determine if land disposal restrictions impose treatment for hexone tank contents.

[a] 100 nCi/g TRU.
[b] The definition of dangerous waste also includes hazardous waste.
DS = decision statement
MTCA = *Model Toxics Control Act* (WAC 173-340)
TRU = transuranic

1.3.2 Decision Rules

The decision rules for each of the decision statements identified in Section 1.3.1 are summarized in Table 1-3. These "IF...THEN..." statements describe the actions that will be taken based on the results of the data collected.

Table 1-3. Decision Rules. (2 Pages)

DS #	DR #	Decision Rule
1	1	If the maximum detected sampling results from the hexone tank contents exceed the TRU definition of 100 nCi/g, then evaluate the need for additional samples and/or special remedial action alternatives. If the maximum detected sampling results from the hexone tank contents do not exceed the TRU definition of 100 nCi/g, then evaluate the other radiological constituents and the nonradiological constituents in accordance with DRs #2 and #3.
2	2	If the RESRAD analysis of the maximum detected sampling results for the radiological COCs from the hexone tank contents does not exceed the annual exposure limits for human health protection, then the tanks may continue to be evaluated for in situ remediation via DR #3. If the RESRAD analysis of the maximum detected sampling results for the radiological COCs from the hexone tank contents exceeds the annual exposure limits for human health protection, then the tanks may not be evaluated for in situ remediation. Analyze the nonradiological constituents in accordance with DR #3.
3	3	If the maximum detected sampling results for the nonradiological COCs from the hexone tank contents do not exceed the MTCA Method B cleanup levels, then the tanks may be evaluated for in situ remediation. If the maximum detected sampling results for the nonradiological COCs from the hexone tank contents exceed the MTCA Method B cleanup levels, then the tanks may not be evaluated for in situ remediation.

Table 1-3. Decision Rules. (2 Pages)

DS #	DR #	Decision Rule
4	4	If the detected values for the chemical/physical characteristics and distribution of contaminants within the hexone tanks do properly reflect the conceptual model, use the model for remedial alternative selection and remedial action planning. If the detected values for the chemical/physical characteristics and distribution of contaminants within the hexone tanks do not properly reflect the conceptual model, revise the model prior to remedial alternative selection and remedial action planning.
5a	5a	If the maximum radiological analytical results from the hexone tank contents indicate that the radiological activity exceed the disposal facility waste acceptance criteria limits, then the tank contents will be evaluated for compliance with nonradiological constituents, and disposition options will be discussed with the regulators. If the maximum radiological analytical results from the hexone tank contents indicate that the radiological activity do not exceed the disposal facility waste acceptance criteria limits, then the tank contents will be evaluated for compliance with nonradiological constituents in accordance with DR #5b.
5b	5b	If the maximum nonradiological analytical results indicate that the nonradiological constituent concentrations exceed the disposal facility waste acceptance criteria limits, then the material will be evaluated for chemical waste designation, and disposition options will be discussed with the regulators. If the maximum nonradiological analytical results indicate that the nonradiological constituent concentrations do not exceed the disposal facility waste acceptance criteria limits, then the material will be evaluated for chemical waste designation in accordance with DR #6.
6	6	If process knowledge or single sample concentrations (as applicable) of the detected analytical value indicate that the waste material do not designate as dangerous or polychlorinated biphenyl waste, then the material will be designated as nondangerous waste. If process knowledge or single sample concentrations (as applicable) of the detected analytical value indicate that the waste material designates as dangerous or polychlorinated biphenyl waste, then the material will be evaluated for treatment and onsite disposal in accordance with DR #7.
7	7	If the analytical results of any grab sample indicate that land disposal restriction imposed treatment is required, then treat the waste material, resample, and evaluate for disposal. If all of the grab sample analytical sample results indicate that land disposal restriction imposed treatment is not required for the waste material, then dispose in an onsite waste disposal facility.

DR = decision rule
RESRAD = RESidual RADioactivity dose model (ANL 1998)

1.3.3 Error Tolerance and Decision Consequences

This subsection provides a summary of the evaluation of error tolerances and decision consequences associated with the project decisions listed in Section 1.3.2. This evaluation is presented in greater detail in Step 2 of the DQO summary report (BHI 2000a). The evaluation (as well as a consideration of project constraints such as time, cost, field operations, and worker health considerations) led to optimization of the sampling design (discussed in Section 1.3.4).

As described in the following subsection, the initial sample design is judgmental where the resulting laboratory data will be subject to statistical analyses and an iterative process will be used to achieve the needed confidence.

1.3.4 Sample Design Summary

This subsection describes the overall sample design rationale as it relates to the individual decision statements. The operational/procedural details of the sampling are described in Section 3.0.

The selected sampling design employs an observational sampling strategy that is intended to verify the conceptual model for the tanks and to provide empirical data to address the decisional requirements. The stages of the sampling design and the basis for each stage are described in the following subsections.

1.3.4.1 Video Record. The sampling design includes deploying a video camera into the tanks through the 4-in.-diameter risers or the 24-in.-diameter manhole to verify the conceptual model of the tank residue configurations and guide the sampling effort. This operation is critical to providing defensible, representative samples.

If the video camera work verifies the waste conceptual model, the sampling design will remain unchanged. If the video camera work reveals that the conceptual model is erroneous, the sampling design will be revised accordingly to accommodate the data quality requirements for this project.

1.3.4.2 Non-Statistical Sampling. Non-statistical (judgmental) sampling supports decision rules #2 through #7. The sampling performed will include physical sampling of the tank contents from the 24-in.-diameter manhole and, if feasible, the 4-in.-diameter riser. One liquid sample will be collected from each tank if liquids are present in sufficient quantity. The liquid sample will be collected from either the 24-in.-diameter manhole or the 4-in.-diameter riser. If sampling conditions allow, one sample will be collected from the tar residue under each access port in each tank. Also, if sampling conditions allow, one sample will be collected from the region between the two access ports in each tank.

1.3.4.3 Judgmental/Statistical Sampling. This portion of the sampling design focuses on resolving decision rule #1. It is necessary to provide a statistical determination for the transuranic (TRU) decision because of the potentially significant consequences of a wrong decision. As discussed in DQO Step 6, this stage of the sampling design employs the phased-sampling concept that was used to release the 105-C fuel storage basin, *Data Quality Objectives Summary Report for the Release of the 105-C Below-Grade Structures and Underlying Soils* (BHI 1999). This design concept is also included as a contingency sampling design in the 100 Area Remaining Sites SAP (DOE-RL 2000b).

The first phase of this sampling design is judgmental, requiring the collection of five samples from the tar residue at the bottom of the tanks. Four samples will be collected from the 24-in.-diameter manhole and one sample will be collected from the 4-in.-diameter riser from each tank. These samples will be analyzed only for TRU isotopes. If all sample results indicate that the total of all TRU isotope concentrations are below the TRU limit of 100 nCi/g, a variance analysis will be performed on the analytical results. If the variance analysis indicates the variability between the five Phase I samples is within an acceptable range (so the TRU upper confidence level [UCL] is less than 100 nCi/g), there will be no need for further sampling to support the TRU decision. If, however, the variability value indicates additional sampling is required to support the TRU decision, the project team will evaluate the costs and benefits associated with further characterization or remedial action planning for TRU waste disposition.

The results of the video camera work shall be used to support the judgmental/statistical sampling design. The four samples collected from under the 24-in.-diameter manhole should be spaced as far apart in the X-Y plane as is practically achievable to avoid co-located sampling. In addition, samples should be collected from varying depths within the tar residue, if possible.

It should be noted that although the judgmental and judgmental/statistical sampling are presented as uniquely different, the samples may be shared if adequate sample media are obtained.

2.0 QUALITY ASSURANCE PROJECT PLAN

This QAPjP presents the policies, organizations, objectives, and functional activities/procedures associated with the remedial sampling and analysis activities for the 276-S-141/142 Hexone Tank Characterization/Stabilization Project.

This QAPjP follows the EPA guidelines contained in *EPA Guidance for Quality Assurance Project Plans* (EPA 1998) and *EPA Requirements for Quality Assurance Project Plans* (EPA 1999). The following sections correlate with the subtitles found in the EPA guidelines (EPA 1998).

2.1 PROJECT MANAGEMENT

This section addresses the basic areas of project management and will ensure that the project has a defined goal, that the participants understand the goal and the approach to be used, and that the planned outputs have been appropriately implemented and documented.

2.1.1 Project/Task Organization

The sampling efforts defined in this SAP will be coordinated through the Environmental Restoration Contractor (ERC) on behalf of the U.S. Department of Energy (DOE). The following organizations will provide support for the sampling efforts:

- The Surveillance/Maintenance and Transition (S/M&T) Project organization will provide project management, task leadership, and project engineering support for the planning and sampling associated with this SAP. This SAP is implemented under the direction of the S/M&T task lead. Support will include the following:

  - Provide project, task, and engineering management necessary to carry out tasks
  - Act as a liaison to ERC functional organizations, as required
  - Provide the radiological work permits (RWPs)
  - Recommend as low as reasonably achievable actions where necessary
  - Coordinate the performance of radiological surveys
  - Provide radiation control coverage for the task team
  - Provide radiological surveys to support sample collection, packaging, and shipping
  - Provide radiological survey packages to summarize survey results
  - Provide radiological survey instrumentation.

- The Field Support functional organization will provide field management, field engineering, and coordination of other field support functions as required to perform this task. This includes safety and health, radiological monitoring, supervision, and labor resources. Support will include the following:

- Prepare work packages to support the task team
- Conduct and document pre-job meetings when supporting the task team
- Provides field support to the task team
- Provide coordination with other Hanford Site organizations (e.g., Radiation Control and Safety) to support the task team
- Provide the approved job hazard analysis
- Provide industrial safety support and monitoring for the task team.

NOTE: Personal protective equipment to be worn during sampling shall be listed on the job-specific activity hazard analysis and the RWP, as required.

- The Environmental Technologies organization will provide waste management and disposal support. Support will include the following:

  - Provide waste designation
  - Prepare waste profiles
  - Provide waste transportation specialist.

- The Sampling and Characterization organization will provide personnel to support field activities including sample collection, sample packaging, and sample shipment. The Decontamination and Decommissioning Characterization organization shall also coordinate analytical services and data management support with the Analytical Field Services organization. Support will include the following:

  - Assist the Field Support organization in creating the task instruction
  - Coordinate sampling and analysis activities
  - Oversee sampling activities
  - Prepare the final data information package for the project files
  - Provide certified clean sampling bottles/containers
  - Perform/support sampling
  - Document sampling activities in a controlled logbook
  - Initiate chain-of-custody documentation for samples
  - Package and transport samples to the laboratory or shipping center.

- The Sample and Data Management organization will support the sampling and analytical work by providing the following support and services:

  - Develop and issue the Sample Authorization Form (SAF)
  - Provide unique sample numbers for sample identification
  - Arrange for laboratory analysis of samples
  - Receive data packages from the laboratory
  - Validate data to the level identified in this plan
  - Provide laboratory data packages.

- The Compliance and Quality Programs organization shall be responsible for performing independent quality assurance (QA) activities, as appropriate.

- The field characterization team consists of the Bechtel Hanford, Inc. (BHI) field engineer, characterization specialist, and waste transportation specialist.

- Data users include the following:

  - Waste Management
  - Project Engineering
  - Radiological Engineering
  - Safety and Health
  - Industrial Safety
  - QA
  - EPA, Ecology, and DOE.

2.1.2 Problem Definition/Background

In May 2000, a NOC was issued by Ecology regarding current operation of the 276-S-141/142 hexone tanks. In September 2000, *Data Quality Objective for 276-S-141/142 Hexone Tank Characterization/ Stabilization Project* (BHI 2000a) was issued. The DQO summary report outlines a sampling and analysis strategy to provide waste verification and designation data.

2.1.3 Project/Task Description

The data collected by this sampling/analysis effort will be used to for the following purposes:

- Verify the conceptual model of the tank contents by providing information on the volume, location, and matrix of tank residue

- Designate the tank residue materials in accordance with the requirements of WAC 173-303

- Support an engineering evaluation of potential stabilization options for the hexone tanks.

2.1.4 Quality Assurance Objectives and Criteria for Measurement Data

The QA objective of this QAPjP is to develop implementation procedures that will provide data of known and appropriate quality for the needs identified through the DQO process (BHI 2000a). Data quality is assessed by representativeness, comparability, accuracy, precision, and completeness. Definitions of these terms, applicable procedures, and level of effort are described below. The applicable quality control (QC) procedures, quantitative target limits, and level of effort for assessing data quality are dictated by the intended use of the data and the nature of the analytical methods. The alignment of analytical parameters, applicable detection levels, analytical precision, accuracy, and completeness with the needs identified in the DQO process are presented in Table 2-1.

The detection limits shown in Table 2-1 meet the DQO requirements identified in Section 1.0. Actual laboratory reporting limits may be higher due to sample-specific matrix interferences. The sample-specific detection limits will be reported for individual analytes.

Representativeness is a measure of how closely the results reflect the actual concentration or distribution of the chemical compounds in the matrix samples. Sampling plan design, sampling techniques, and sample-handling protocols (e.g., for storage, preservation, and transportation) have been developed and are further discussed in this SAP. The proposed documentation will establish that protocols have been followed and that sample identification and integrity are ensured.

Comparability expresses the confidence with which one data set can be compared to another. Data comparability will be maintained using defined procedures and consistent methods and units. Actual detection limits depend upon the sample matrix and will be reported as defined for the specific samples.

Accuracy is an assessment of the closeness of the measured value to the true value. The accuracy of chemical/radiological test results is assessed by spiking materials with known standards, performing the analysis, and establishing the recovery. For matrix spikes, known amounts of a standard compound (either the analyte of interest or a surrogate material expected to behave chemically the same as the analyte of interest) are added to the samples and carried through the analysis. Matrix spikes are not applicable to the proposed measurements. For these measurements, accuracy is assessed primarily through spiked materials having similar properties to the samples.

2.1.5 Special Training Requirements/Certification

Training or certification requirements needed by personnel are described in BHI-HR-02, *ERC Training Procedures*, and BHI-QA-03, *ERC Quality Assurance Program Plans*, Plan No. 5.1, "Field Sampling Quality Assurance Program Plan," Plan No. 5.2, "Onsite Measurements Quality Assurance Program Plan," and Plan No. 5.3, "Radiological Measurements and Environmental Support Quality Assurance Program Plan." Field personnel shall have completed the following mandatory training before starting work:

- Occupational Safety and Health Administration 40-Hour Hazardous Waste Worker Training
- Radiation Worker Training
- Hanford General Employee Training.

Field personnel shall also be trained in accordance with BHI-HR-02, Procedure 1.5, "ERC TSD/Accumulation Area Training," including Appendix 11, "Hexone Storage and Facility TSD."

Table 2-1. Analytical Performance Requirements. (4 Pages)

COC	CAS #	Action Levels and Bases Soil Only		Name/Analytical Technique	Liquids[b] Low Level	Liquids[b] High Level	Solid-Other Low Level	Solid-Other High Level	TRU Threshold	Accuracy (% Recovery)	Precision Relative Deviation
Radionuclides		RR[a] pCi/g	C/I[a] pCi/g	N/A	pCi/L	pCi/L	pCi/L	pCi/g	nCi/g	%	%
Americium-241	14596-10-2	31	210	Americium isotopic – AEA	1	400	1	4,000	100	75-130	± 35
Curium-244	13981-15-2	--	--	Curium isotopic – AEA	1	400	1	4,000	100	75-130	± 35
Carbon-14	14762-75-5	5.2	33,100	Carbon-14 – liquid scintillation	200	N/A	50	N/A	N/A	60-140	± 35
Cesium-137	10045-97-3	6.2	25	GEA	15	200	0.1	2,000	N/A	75-130	± 35
Cobalt-60	10198-40-0	1.4	5.2	GEA	25	200	0.05	2,000	N/A	75-130	± 35
Europium-152	14683-23-9	3.3	12	GEA	50	200	0.1	2,000	N/A	75-130	± 35
Europium-154	15585-10-1	3	11	GEA	50	200	0.1	2,000	N/A	75-130	± 35
Europium-155	14391-16-3	125	449	GEA	50	200	0.1	2,000	N/A	75-130	± 35
Hydrogen-3	10028-17-8	359	14,200	GEA	400	400	400	400	N/A	75-130	± 35
Plutonium-238	13981-16-3	37	483	Plutonium isotopic – AEA	1	130	1	1,300	100	75-130	± 35
Plutonium-239/240	Pu-239/240	34	243	Plutonium isotopic – AEA	1	130	1	1,300	100	75-130	± 35
Total radioactive strontium	Sr-rad	4.5	2,500	Total radioactive strontium – GPC	2	80	1	800	N/A	75-130	± 35
Technetium-99	14133-76-7	5.7	410,000	Technetium-99 – liquid scintillation	15	400	15	4,000	N/A	75-130	± 35
Uranium-234	13966-29-5	160	1,200	Uranium isotopic – AEA (pCi) ICPMS (mg)	1	0.002 mg/L	1	0.02 mg/kg	N/A	75-130	± 35
Uranium-235	15117-96-1	26	100	Uranium isotopic – AEA (pCi) ICPMS (mg)	1	0.002 mg/L	1	0.02 mg/kg	N/A	75-130	± 35
Uranium-238	U-238	85	420	Uranium isotopic – AEA (pCi) ICPMS (mg)	1	0.002 mg/L	1	0.02 mg/kg	N/A	75-130	± 35
Chemicals											
Organics	CAS #	Method B mg/kg	Method C mg/kg	N/A	mg/L	mg/L	mg/kg	mg/kg	nCi/g	%	%
n-Butyl alcohol	71-36-3	8,000	350,000	Non-halogenated VOA – 8015 – GC	5	N/A	5	N/A	N/A	d	± 35
Kerosene (paraffin hydrocarbons)	8008-20-6	200	200	Non-halogenated VOA - 8015M – GC modified for hydrocarbons	0.5	0.5	5	5	N/A	d	± 35

Table 2-1. Analytical Performance Requirements. (4 Pages)

COC	CAS #	Action Levels and Bases Soil Only		Name/Analytical Technique	Liquids[b] Low Level	Liquids[b] High Level	Solid-Other Low Level	Solid-Other High Level	TRU Threshold	Accuracy (% Recovery)	Precision Relative Deviation
Organics (continued)		Method B mg/kg	Method C mg/kg	N/A	mg/L	mg/L	mg/kg	mg/kg	nCi/g	%	%
2-propanone (acetone)	67-64-1	8,000	350,000	Volatile organics – 8260 – GCMS	0.02	0.02	0.02	0.02	N/A	d	± 35
2-butanone	78-93-3	48,000	2,100,000	Volatile organics – 8260 – GCMS	0.01	0.01	0.01	0.01	N/A	d	± 35
4-methyl-2-pentanone (hexone)	108-10-1	6,400	280,000	Volatile organics – 8260 – GCMS	0.01	0.01	0.01	0.01	N/A	d	± 35
2-hexanone	591-78-6	None	None	Volatile organics – 8260 – GCMS	0.02	0.02	0.02	0.02	N/A	d	± 35
Tributyl phosphate	126-73-8	None	None	Semi-volatiles – 8270 - GCMS	0.1	0.5	3.3	10	N/A	d	± 35
Polychlorinated biphenyls	1336-36-3	0.5	17	Polychlorinated biphenyls – 8082[c] – GC	0.0005	0.005	0.0165	0.1	N/A	d	± 35
Inorganics											
Cyanide	57-12-5	1,600	70,000	Total cyanide – 9010 – colorimetric	0.005	0.005	0.5	0.5	N/A	75-125	± 35
Phosphate	14265-44-2	N/A	N/A	Anions – 300.0 – IC	0.5	15	5	40	N/A	75-125	± 35
Nitrate	14797-55-8	128,000	Unlimited	Anions – 300.0 – IC	0.25	10	2.5	40	N/A	75-125	± 35
Nitrite	14797-65-0	8,000	350,000	Anions – 300.0 – IC	0.25	15	2.5	20	N/A	75-125	± 35
Sulfate	14808-79-8	25,000	25,000	Anions – 300.0 – IC	0.5	15	5	40	N/A	75-125	± 35
Chloride	16887-00-6	25,000	25,000	Anions – 300.0 – IC	0.2	5	2	5	N/A	75-125	± 35
Sulfides	18496-25-8	N/A	N/A	Sulfide – 9030 – colorimetric	0.5	N/A	5	N/A	N/A	75-125	± 35
Metals											
Mercury	7439-97-6	24	1,050	Mercury – 7471 – CVAA	NA	N/A	0.2	0.2	N/A	75-125	± 35
Lead	7439-92-1	353	1,000	Metals – 6010 – ICP	0.1	0.2	10	20	N/A	75-125	± 35
Nickel	7440-02-0	1,600	70,000	Metals – 6010 – ICP	0.04	0.04	4	4	N/A	75-125	± 35
Silver	7440-22-4	400	17,500	Metals – 6010 – ICP	0.02	0.02	2	2	N/A	75-125	± 35

Table 2-1. Analytical Performance Requirements. (4 Pages)

COC	CAS #	Action Levels and Bases Soil Only		Name/Analytical Technique	Liquids[b] Low Level	Liquids[b] High Level	Solid-Other Low Level	Solid-Other High Level	TRU Threshold	Accuracy (% Recovery)	Precision Relative Deviation
Metals (continued)		Method B mg/kg	Method C mg/kg	N/A	mg/L	mg/L	mg/kg	mg/kg	nCi/g	%	%
Antimony	7440-36-0	40	1,750	Metals – 6010 – ICP	0.06	0.12	6	12	N/A	75-125	± 35
Arsenic	7440-38-2	1.7	219	Metals – 6010 – ICP	0.1	0.2	10	20	N/A	75-125	± 35
Barium	7440-39-3	5,600	245,000	Metals – 6010 – ICP	0.2	0.2	20	20	N/A	75-125	± 35
Beryllium	7440-41-7	0.23	30.5	Metals – 6010 – ICP	0.005	0.01	0.5	1	N/A	75-125	± 35
Cadmium	7440-43-9	80	3,500	Metals – 6010 – ICP	0.005	0.01	0.5	1	N/A	75-125	± 35
Chromium (total)	7440-47-3	80,000	Unlimited	Metals – 6010 – ICP	0.01	0.01	1	2	N/A	75-125	± 35
Copper	7440-50-8	2,960	130,000	Metals – 6010 – ICP	0.025	0.025	2.5	2.5	N/A	75-125	± 35
Selenium	7782-49-2	400	17,500	Metals – 6010 – ICP	0.1	0.2	10	20	N/A	75-125	± 35
Lead	7439-92-1	353	1,000	Metals – 6010 – ICP (trace)	0.01	N/A	1	N/A	N/A	75-125	± 35
Silver	7440-22-4	400	1,750	Metals – 6010 – ICP (trace)	0.005	N/A	0.5	N/A	N/A	75-125	± 35
Antimony	7440-36-0	40	1,400	Metals – 6010 – ICP (trace)	0.01	N/A	1	N/A	N/A	75-125	± 35
Arsenic	7440-38-2	1.7	219	Metals – 6010 – ICP (trace)	0.01	N/A	1	N/A	N/A	75-125	± 35
Barium	7440-39-3	5,600	245,000	Metals – 6010 – ICP (trace)	0.005	N/A	0.5	N/A	N/A	75-125	± 35
Cadmium	7440-43-9	80	3,500	Metals – 6010 – ICP (trace)	0.005	N/A	0.5	N/A	N/A	75-125	± 35
Chromium (total)	7440-47-3	80,000	Unlimited	Metals – 6010 – ICP (trace)	0.01	N/A	1	N/A	N/A	75-125	± 35
Uranium (total)	7440-61-1	240	10,500	Uranium total – kinetic phosphorescence analysis	0.0001	0.02	1	0.2	N/A	60-140	± 35
Selenium	7782-49-2	400	17,500	Metals – 6010 – ICP (trace)	0.01	N/A	1	N/A	N/A	75-125	± 35
Lead	7439-92-1	353	1,000	TCLP metals by ICP – 1311/6010	5,000	5,000	As extract	As extract	N/A	75-125	± 35

Table 2-1. Analytical Performance Requirements. (4 Pages)

COC	CAS #	Action Levels and Bases Soil Only		Name/Analytical Technique	Liquids[b] Low Level	Liquids[b] High Level	Solid-Other Low Level	Solid-Other High Level	TRU Threshold	Accuracy (% Recovery)	Precision Relative Deviation
Metals (continued)		Method B mg/kg	Method C mg/kg	N/A	mg/L	mg/L	mg/kg	mg/kg	nCi/g	%	%
Silver	7440-22-4	400	17,500	TCLP metals by ICP – 1311/6010	5,000	5,000	As extract	As extract	N/A	75-125	± 35
Arsenic	7440-38-2	1.7	219	TCLP metals by ICP – 1311/6010	5,000	5,000	As extract	As extract	N/A	75-125	± 35
Barium	7440-39-3	5,600	245,000	TCLP metals by ICP – 1311/6010	100,000	100,000	As extract	As extract	N/A	75-125	± 35
Cadmium	7440-43-9	80	3,500	TCLP metals by ICP – 1311/6010	1,000	1,000	As extract	As extract	N/A	75-125	± 35
Chromium (total)	7440-47-3	80,000	Unlimited	TCLP metals by ICP – 1311/6010	5,000	5,000	As extract	As extract	N/A	75-125	± 35
Selenium	7782-49-2	400	17,500	TCLP metals by ICP – 1311/6010	1,000	1,000	As extract	As extract	N/A	75-125	± 35
Other parameters											
Ignitability	--	--	--	Ignitability – 1020	N/A	N/A	N/A	N/A	N/A	N/A	± 35
pH	--	N/A	N/A	pH – 9045 – electrode	N/A	N/A	N/A	N/A	N/A	N/A	± 35
TOC	--	--	--	TOC – 9060	1,000	1,000	25,000	25,000	N/A	75-125	± 35

[a] RR = rural residential; C/I = commercial industrial. Values from DOE/RL-2000-38 Draft A, *200-TW-1 Scavenged Waste Group Operable Unit and 200-TW-2 Tank Waste Group Operable Unit RI/FS Work Plan* (DOE-RL 2000a).

[b] Water values for sampling QC (e.g., equipment blanks/rinses).

[c] All four-digit numbers refer to *Test Methods for Evaluating Solid Waste*, SW-846 (EPA 1986).

[d] Accuracy criteria as defined within the referenced EPA procedure.

AEA = alpha energy analysis
CVAA = cold vapor atomic absorption
GC = gas chromatography
GCMS = gas chromatographic mass spectrometry
GEA = gamma energy analysis
GPC = gas proportional counting
IC = ion chromatography
ICP = inductively coupled plasma
ICPMS = inductively coupled plasma mass spectrometry
N/A = not applicable
TOC = total organic carbon
VOA = volatile organic analysis

2.1.6 Documentation and Records

Field documentation (including change control) will be as described in Section 3.0 of this SAP. Analytical documentation will be in accordance with the *Statement of Work for Environmental and Work Characterization Analytical Services* (RFS 1999). Overall project documentation will be in accordance with ERC program planning documents.

2.2 MEASUREMENT/DATA ACQUISITION

The following subsections present the requirements for sampling methods, sample handling and custody, analytical methods, and field and laboratory QC. The requirements for instrument calibration, maintenance, supply inspections, and data management are also discussed.

2.2.1 Sampling Process Design

A summary of the sampling process design is presented in Section 1.3.4. Section 3.0 presents tables that identify the sampling locations, total number of samples to be collected, sampling procedures to be implemented, analyses to be performed, and sample management requirements.

2.2.2 Sampling Methods Requirements

The procedures to be implemented in the field are described in Section 3.0 and will be consistent with those outlined in BHI-EE-01, *Environmental Investigations Procedures*, including the following:

- Procedure 1.5, "Field Logbooks"
- Procedure 2.0, "Sample Event Coordination"
- Procedure 3.0, "Chain of Custody"
- Procedure 3.1, "Sample Packaging and Shipping"
- Procedure 4.4, "Container Sampling."

2.2.3 Sample Handling and Custody Requirements

All sample handling, shipping, and custody requirements will be performed in accordance with BHI-EE-01, Procedure 3.1, "Sample Packaging and Shipping," Procedure 3.0, "Chain of Custody," and Procedure 4.2, "Sample Storage and Shipping Facility."

2.2.4 Analytical Methods Requirements

2.2.4.1 Onsite Methods. Field measurements for radionuclides and hazardous chemicals will be performed in accordance with the procedures identified in Section 3.0.

2.2.4.2 Offsite (Standard Fixed Laboratory) Methods. Analytical parameters and methods are listed in Table 2-1. The QA/QC procedures, detection limit requirements, and documentation for individual methods will be in accordance with the specifications outlined in the *Statement of Work for Environmental and Work Characterization Analytical Services* (RFS 1999). Laboratory-specific standard operating procedures (SOPs) for individual analytical methods will also be implemented.

2.2.5 Quality Control Requirements

Analytical QC requirements are included in the procedures referenced in Section 2.2.4. Field QC is discussed in Section 3.0. The QC samples are introduced into the collection system to monitor the adequacy of the sampling system and the integrity of samples during transfer from the field collection through laboratory analysis. The minimum QC sample requirements for the field sample collection process and laboratory analyses are defined below.

2.2.5.1 Field Quality Control Samples. The QC sample requirements for the sampling process are as follows:

- Equipment blanks will be collected to assess the cleanliness of the sampling operation, the effectiveness of the sample equipment decontamination process, and the potential sampling environment contaminant contribution. The blanks will be analyzed for the same chemical analytes as actual samples collected during use of the equipment. Blanks will be collected at a minimum frequency of one per sampling method. All sample results will be evaluated to determine the possible effects of any contamination that may be detected in the equipment blank.

- Field duplicate samples will be collected during sampling at a minimum frequency of 1 per 20 samples of the same matrix. Field duplicates are two samples produced from the same material and collected in the same location. Field duplicates are analyzed independently at the primary laboratory and provide information concerning the homogeneity of the matrix, as well as an evaluation of the precision of the sampling and analysis process.

2.2.5.2 Standard Fixed Laboratory Quality Control Requirements. The minimum QC sample requirements for the analytical laboratory are identified below. Additional method-specific QC samples are prescribed in the references provided in Section 2.2.4.

Laboratory QC requirements will meet or exceed the requirements identified in the *Hanford Analytical Services Quality Assurance Requirements Document* (HASQARD) (DOE-RL 1996a). The requirements in this document are implemented through the analytical service statement of work (RFS 1999):

- Method performance (e.g., laboratory control samples and blank spikes)
- Potential contamination of samples (e.g., blanks)
- Analytical precision (e.g., duplicates and spike duplicates as appropriate to the method)
- Analytical accuracy (e.g., spikes, tracers, and carriers) as appropriate to the method.

2.2.6 Instrument/Equipment Testing, Inspection, and Maintenance Requirements

All onsite environmental instruments shall be tested, inspected, and maintained in accordance with BHI-QA-03, Plan No 5.2 and Plan No. 5.3. The results from all testing, inspection, and maintenance activities shall be recorded in a bound logbook in accordance with the procedures outlined in BHI-EE-01, Procedure 1.5, "Field Logbooks."

2.2.7 Instrument Calibration and Frequency

All onsite environmental instruments shall be calibrated in accordance with BHI-QA-03, Plan No. 5.2 or Plan No. 5.3. The results from all instrument calibration activities shall be recorded in a bound logbook in accordance with procedures outlined in BHI-EE-01, Procedure 1.5. Where applicable, tags will be attached to field screening and onsite analytical instruments, noting the date when the instrument was last calibrated and the calibration expiration date.

2.2.8 Inspection/Acceptance Requirements for Supplies and Consumables

Procurement activities will be limited to providing BHI Procurement with procurement requisitions. All subject activities will meet the requirements of BHI Procurement procedures found in BHI-PR-01, *ERC Procurement Procedures.*

The project will review received items and reagents to conform to the specifications set in the procurement requisition. If the items or reagents do not meet specifications, the items/reagents will be dispositioned through the nonconformance system.

The acceptability of new standards will be determined by comparing the new standard with previous acceptable standards. Reagent acceptability will be determined by running blanks on the new reagents. New reagents and standards will be separated from other standards and reagents until they have been checked and accepted.

2.2.9 Data Management

Laboratory data resulting from the implementation of this SAP will be managed and stored by ERC's Sample Management organization in accordance with BHI-EE-01, Section 2.0, "Sample Management."

All validated reports and supporting analytical data packages shall be subject to final technical review by qualified reviewers before submittal to regulatory agencies or inclusion in reports or technical memoranda, at the direction of the BHI project task lead. Electronic data access, when appropriate, shall be through computerized databases (e.g., Hanford Environmental Information System [HEIS]). Where electronic data are not available, hard copies will be provided in accordance with Section 9.6 of the *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement) (Ecology et al. 1998).

2.2.10 Sample Preservation, Containers, and Holding Times

Sample volumes and bottle types depend on the laboratory and analytical methods used. Sample preservation, container types and sizes, and holding time requirements for the analysis to be performed will be established and documented in the project-specific SAFs.

2.3 ASSESSMENT/OVERSIGHT

2.3.1 Assessments and Response Actions

The Compliance and Quality Programs group may conduct random surveillance and assessments in accordance with BHI-MA-02, *ERC Project Procedures*, Procedure 2.9, "Surveillance," to verify compliance with the requirements outlined in this SAP, project work packages, the BHI quality management plan, BHI procedures, and regulatory requirements.

Deficiencies identified by these assessments shall be reported in accordance with BHI-MA-02, Procedure 2.7, "Self-Assessment." When appropriate, corrective actions will be taken by the project engineer in accordance with HASQARD, Volume 1, Section 4.0 (DOE-RL 1996a), to minimize recurrence. Change control documentation will be as described in Section 3.3.2.

2.3.2 Reports to Management

Management shall be made aware of all deficiencies identified by self-assessments. Deficiencies shall be reported in accordance with BHI-MA-02, Procedure 2.7.

2.4 DATA VALIDATION AND USABILITY

2.4.1 Data Review, Validation, and Verification Requirements

Data verification and validation are performed on analytical data sets, primarily to confirm that sampling and chain-of-custody documentation are complete, sample numbers can be tied to the specific sampling location, samples were analyzed within the required holding times, and analyses met the data quality requirements specified in the applicable DQO document. The data collected in accordance with this SAP will not be used to determine final closure decisions. Therefore, the data will not undergo formal data validation. Routine verification of the data packages will be conducted. The QA/QC process used in the SOPs will be followed to ensure that the data are useable.

2.4.2 Validation and Verification Methods

All data verification and validation shall be performed in accordance with BHI-EE-01, Procedure 2.5, "Data Package Validation Process."

3.0 FIELD SAMPLING PLAN

3.1 SAMPLING OBJECTIVES

The objective of the FSP is to delineate the sampling and analysis activities/procedures needed to address the decision rules identified in Step 5 of the DQO process (BHI 2000a), which are described in Section 1.3.2 of this SAP. Consistent with the sampling design proposed in Step 7 of the DQO process (described in Section 1.3.4 of this SAP), the following sections include sampling and field survey locations, total number of samples to be collected, analyses to be performed, sampling and documentation procedures to be implemented, and sample and sampling-derived waste management procedures. This section provides comprehensive procedures for the field activities associated with the project-specific sampling and analysis design and serves as an instruction guide for field personnel.

3.2 SAMPLING AND SURVEY LOCATIONS AND FREQUENCY

The following subsections contain descriptions of sampling and survey activities that are consistent with the sampling design presented in Section 1.3.4 of this SAP. The specific procedures are presented in chronological order of tasks to be performed. A summary is presented in Table 3-1. Umbrella procedures that apply to all of these activities are identified in Sections 3.3, 3.4, and 3.5.

Table 3-1. Sampling Design. (2 Pages)

Sample Collection Strategy	Key Features of Design	Sampling Objective and Analysis
Non-Statistical Sampling for Waste Designation		
Judgmental sampling	If liquid is detected, collect one liquid sample per tank. The sample will be obtained from either of the access ports in each tank.	Sampling to resolve DRs #2 through #7. Analyze for all constituents in Table 1-1, with the exception of TRU isotopes. The solid residue samples will be evaluated for homogeneity based on physical characteristics (e.g., color, texture, and density) and documented in the field logbook. If the sampling specialist determines that the samples are homogenous, the samples will be composited for analysis. If the samples do not appear to be homogenous, the samples will be analyzed separately.
	Collect up to three solid samples of tank residue from each tank. If feasible, one sample is to be obtained from under each of the access ports and one sample from the tank bottom area, between the access ports in each tank. Samples collected from each tank will be composited for analysis.	
	Collect one duplicate sample of each media (liquid or solid) collected from the tanks.	

Table 3-1. Sampling Design. (2 Pages)

Sample Collection Strategy	Key Features of Design	Sampling Objective and Analysis
Judgmental/Statistical Sampling for TRU Determination		
TRU variance sampling	Collect four samples of tank residue through the 24-in.-diameter manhole in each tank.[a] Collect one sample of tank residue through the 4-in.-diameter riser in each tank.[a]	Sampling to resolve DR #1. Analyze samples for TRU isotopes. If all sample results show that the total of TRU isotope concentrations is below 100 nCi/g, perform a variance analysis on the five samples to determine the need for additional samples. If the variance analysis indicates the UCL is less than 100 nCi/g, further sampling will not be required. If the UCL exceeds 100 nCi/g, additional sampling will be required. The project team will evaluate the cost/benefits of further characterization against disposal of the tar residue as TRU waste.
TRU concentration sampling (if needed)	Calculate the number of additional samples required to resolve the TRU decision. Collect the designated number of samples from the access ports in the tanks.	Collection of the statistically derived number of samples to resolve the TRU decision. Analyze only for TRU isotopes.

[a] Judgmental and statistical samples may be collected simultaneously to reduce the total number of samples.

Table 3-2. Sampling Approach/Locations. (2 Pages)

Sampling Objectives	Media	Sampling Approach/ Locations	Number of Samples	Laboratory Analysis
Waste designation	Liquid (if present)	Stainless-steel sample scoop on reach rod. Sample from 24-in.-diameter manhole or 4-in. riser.	One liquid sample per tank (plus duplicate)	All constituents in Table 1-1
Waste designation	Tank residue	Stainless-steel sample scoop on reach rod. One sub-sample from 24-in.-diameter manhole and (if feasible) from 4-in riser of each tank. One sub-sample from the middle portion of each tank. (Samples will be composited for analysis.)	One composite sample[a] per tank (based on field determination of homogeneity), plus duplicate	All constituents in Table 1-1, except for TRU isotopes

Table 3-2. Sampling Approach/Locations. (2 Pages)

Sampling Objectives	Media	Sampling Approach/ Locations	Number of Samples	Laboratory Analysis
TRU variance	Tank residue	Stainless-steel sample scoop on reach rod. Four samples from 24-in.–diameter manhole. One sample from 4-in. riser.	Five samples per tank[b]	TRU constituents
TRU concentration (if needed)	Tank residue	To be determined.	To be determined	TRU constituents

[a] Composite samples will be composed of equal volume subsamples obtained from each sampling location and added to a single sample container for shipment to the laboratory. Actual mixing of the subsamples will be conducted at the laboratory prior to analysis to reduce the potential loss of volatile components.

[b] Judgmental and statistical samples may be collected simultaneously to reduce the total number of samples.

3.3 SAMPLING PROCEDURES, FIELD DOCUMENTATION, AND ONSITE ENVIRONMENTAL MEASUREMENT PROCEDURES

The sampling and onsite environmental measurement procedures to be implemented in the field shall be consistent with those outlined in BHI-EE-01 and BHI-EE-05, *Field Screening Procedures.*

3.3.1 Sampling Procedures

The procedures to be implemented in the field will be consistent with that outlined in BHI-EE-01, including the following procedures:

- Procedure 1.5, "Field Logbooks"
- Procedure 2.0, "Sample Event Coordination"
- Procedure 3.0, "Chain of Custody"
- Procedure 3.1, "Sample Packaging and Shipping"
- Procedure 4.4, "Container Sampling"
- Procedure 4.2, "Sample Storage and Shipping Facility."
-

Field QC samples will be collected as listed in Table 3-3.

Table 3-3. Field Quality Control Samples.

QC Sample Type	Application	Frequency Reference
Equipment blanks	All sampling	One sample per method
Field duplicates	All sampling	Minimum of one sample per sample matrix

3.3.2 Field Documentation and Change Control

Field documentation shall be maintained in accordance with BHI-EE-01, including the following procedures:

- Procedure 1.5, "Field Logbooks"
- Procedure 1.13, "Environmental Site Identification and Information Reporting"
- Procedure 3.0, "Chain of Custody"
- Procedure 4.2, "Sample Storage and Shipping Facility."

All field sampling activities and pertinent information will be documented in a controlled field logbook in accordance with the procedures listed above. Entries will include, but are not limited to, the following information:

- Person performing the sampling activity
- Names of other onsite personnel
- Safety or pre-job meetings held
- Location of sampling activity
- Date and time of sampling
- Sample identification numbers
- Any unusual occurrences
- Sample container dose rates or radiation levels
- Description of sample media.

Samples will be identified using HEIS database sample numbers. The HEIS sample numbers will be issued through the ERC Sample Management organization.

All samples will be maintained under chain of custody (BHI-EE-01, Procedure 3.0). Sample custody will be established at the time of sample collection and will be maintained until samples are transferred to the laboratory for analysis.

To ensure efficient and timely completion of tasks, minor changes can be made to the original work scope (outlined in this SAP) in the field by the project engineer (or designee), provided that the changes do not impact the technical adequacy of the job or negatively impact the work schedule. Such changes shall be documented with justification in a field logbook (BHI-EE-01, Procedure 1.5). The project engineer (or designee) shall notify the project QA officer that the changes have been implemented. If the project engineer (or designee) anticipates that a proposed field change will negatively impact the work schedule and/or requires the approval of the U.S. Department of Energy, Richland Operations Office (RL) and the lead regulatory agency, appropriate notifications shall be made and approvals obtained before implementing the change. The project engineer (or designee) will then take steps to issue the revised SAP as agreed upon by RL and the lead regulatory agency.

3.4 SAMPLE MANAGEMENT

Sample management activities shall be performed in accordance with BHI-EE-01, Section 2.0, "Sample Management."

All sample handling, shipping, and custody requirements will be performed in accordance with BHI-EE-01, Procedure 3.1, "Sample Packaging and Shipping," Procedure 3.0, "Chain of Custody," and Procedure 4.2, "Sample Storage and Shipping Facility." The sample handling, shipping, and custody requirements shall consider *Resource Conservation and Recovery Act of 1976* (RCRA)-listed waste codes.

3.5 MANAGEMENT OF SAMPLE-DERIVED WASTE

Waste generated by sampling activities, if any, will be managed in accordance with BHI-EE-10, *Waste Management Plan*, and the site-specific waste management instruction. Unused samples and associated laboratory waste from the analyses will be dispositioned in accordance with the laboratory contract and agreements for return of the waste to the Hanford Site.

4.0 HEALTH AND SAFETY

All field operations will be performed in accordance with BHI health and safety requirements outlined in BHI-SH-01, *ERC Safety and Health Program*, and the requirements of the *Hanford Site Radiological Control Manual* (HSRCM) (DOE-RL 1996b). Project-specific requirements that are defined in the REDOX safety authorization basis also will be incorporated into the work procedures, as applicable.

Work planning, hazards analysis, and contingency planning will be conducted in accordance with the work control process as described in BHI-MA-02, *ERC Project Procedures*. The project work package will include a job hazard analysis, site-specific health and safety plan, and applicable radiological work permits.

The sampling procedures and associated activities will consider exposure reduction and contamination control techniques that will minimize the radiation exposure to the sampling team, as required by BHI-SH-01 and BHI-QA-01, *ERC Quality Program*.

5.0 REFERENCES

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